

Capability Maturity Model Integration (CMMI) Debrief

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CMMI Debrief

CMMI provides guidance for improving an organization's processes [CERES Data Management] and the ability to manage the development, acquisition, and maintenance of products or services

CMMI Debrief

(Why for CERES DM?)

- NPOESS requirement for ERBS code
- CERES DM has many “single points of failure”
 - CERES DM should operate under consistent “rules for each subsystem
 - A subsystem analyst should be able to move to another subsystem and have a framework with procedures in place that would aid/speed the transition
 - Improve efficiency to meet customer needs

CMMI Debrief

CMMI Web links

<http://www.sei.cmu.edu/>

Select “CMMI – Getting Started”

CMMI Debrief

“V” Model was demonstrated in the
CMMI Introduction Course

- System Engineering Approach
- CMMI builds on this model and provides the structure (framework)

CMMI MODEL REPRESENTATIONS

Staged

Continuous

Overview

- Define Staged and Continuous Representations
- Staged Representation Maturity Levels
- Continuous Representation Capability Levels
- Process Area Capability Levels vs Maturity Levels
- Advantages
- Disadvantages
- Business Perspective Example
- Local SAIC Organization

Definitions

- **Staged Representation**– groups process areas into maturity levels, indicating which process areas to implement to achieve each level.

Continuous Representation– groups process areas by categories and designates capability levels for process improvement within each process.

Staged Representation Maturity Levels

ML 1: Initial (ad hoc, chaotic, heroics, exceed budget and over schedule)

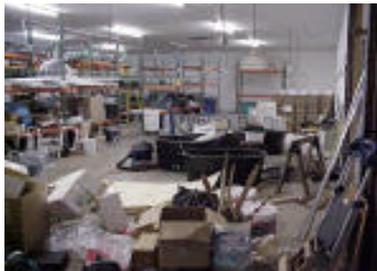
ML 2: Managed (planned, performed, measured, controlled)

ML 3: Defined (tailored, more consistent, more detailed, more rigorous)

Staged Representation Maturity Levels (cont'd)

ML 4: Quantitatively Managed (process performance measured, analyzed)

ML 5: Optimizing (improved process performance)

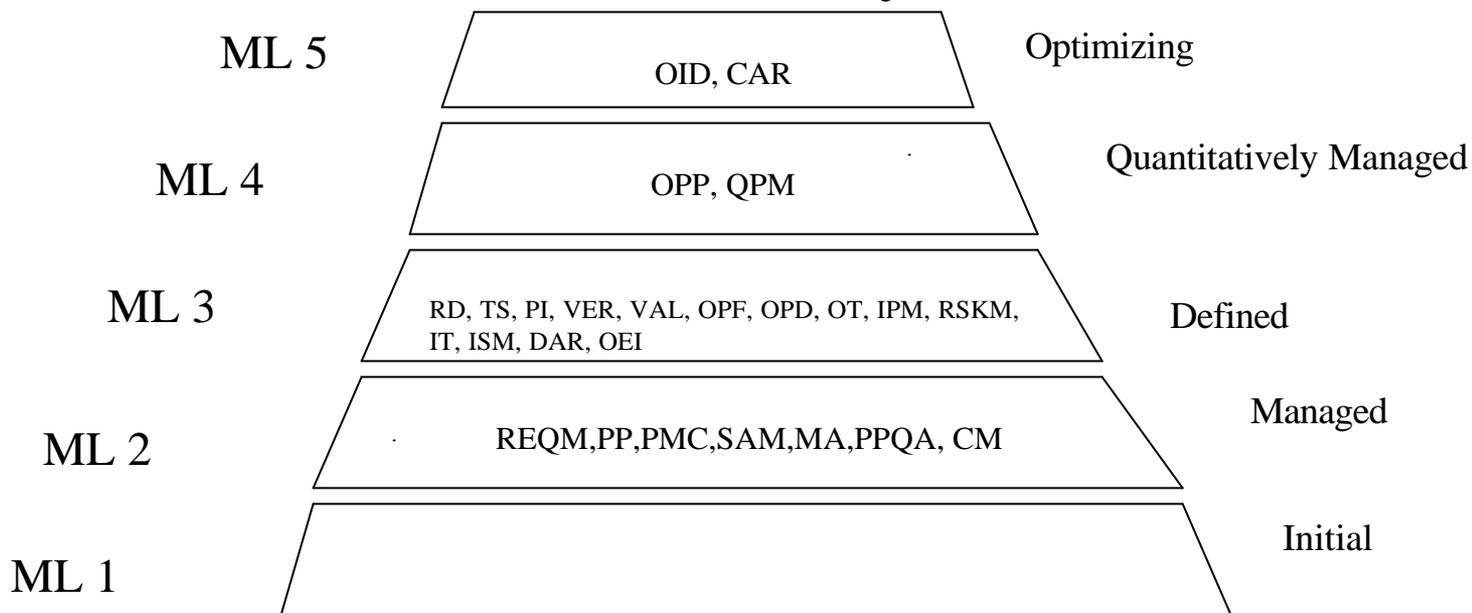


ORDER

CHAOS to ORDER

Staged Representation Maturity Levels (cont'd)

- 5 Maturity Levels (predefined set of process areas for each maturity level)



Maturity Level Hierarchy

Predefined Process Areas For Each Maturity Level

| Level | Focus | Process Area |
|--------------------------|--------------------------------|---|
| 5 Optimizing | Continuous Process Improvement | Organizational Innovation and Deployment (OID) Causal Analysis and Resolution (CAR) |
| 4 Quantitatively Managed | Quantitative Management | Organizational Process Performance (OPP) Quantitative Project Management (QPM) |
| 3 Defined | Process Standardization | Requirements Development (RD) Technical Solution (TS) Product Integration (PI) Verification (VER) Validation (VAL) Organizational Process Focus (OPF) Organizational Process Definition (OPD) Organizational Training (OT) Integrated Project Management (IPM) Risk Management (RSKM) Integrated Teaming (IT) Integrated Supplier Management (ISM) Decision Analysis and Resolution (DAR) Organizational Environment for Integration (OEI) |

Predefined Process Areas In Each Maturity Level

| Level | Focus | Process Area |
|-----------|--------------------------|--|
| 2 Managed | Basic Project Management | Requirements Management (RM) Project Planning (PP) Project Monitoring and Control (PMC) Supplier Agreement Management (SAM) Measurement and Analysis (MA) Process and Product Quality Assurance (PPQA) Configuration Management (CM) |
| 1 Initial | | |
| | | |
| | | |

Continuous Representation Capability Levels

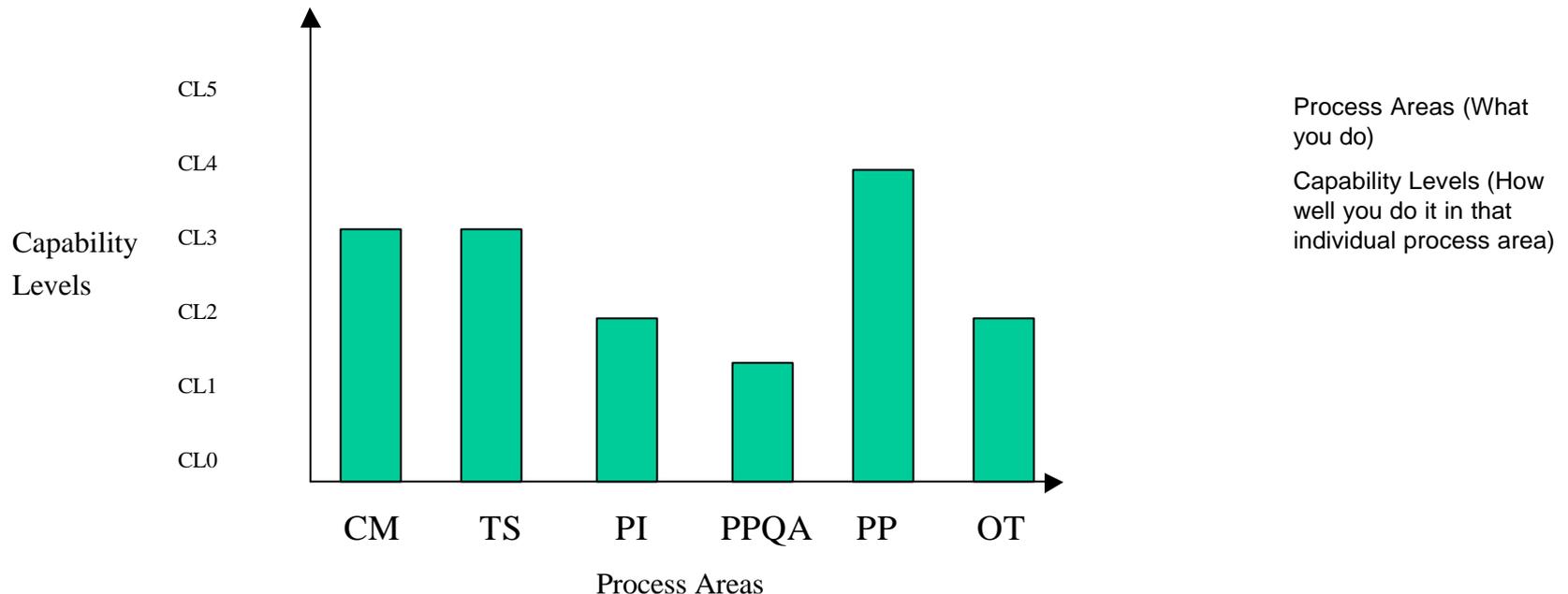
- CL 0: Incomplete (not performed, partially performed)
- CL 1: Performed (supports the work needed to produce identified work products)
- CL 2: Managed (planned, executed)

Continuous Representation Capability Levels (cont'd)

- CL 3: Defined (tailored, measures)
- CL 4: Quantitatively Managed (measured process performance)
- CL 5: Optimizing (continue process improvement)

Continuous Representation Capability Levels (cont'd)

- 6 Capability Levels (represents achievement of process improvement within an individual process area)



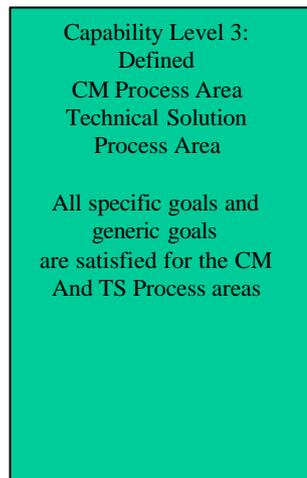
Categorized Continuous Capability Levels

Process Areas are grouped into four categories:

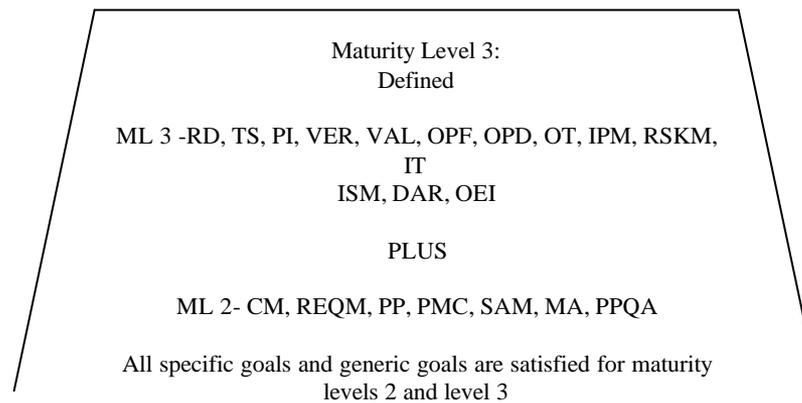
1. **Process Management** (Organizational Process Focus, Organizational Process Definition, Organizational Training, Organizational Process Performance, Organizational Innovation and Deployment)
2. **Project Management** (Project Planning, Project Monitoring and Control, Supplier Agreement Management, Integrated Project Management for IPPD (Integrated Project Management, Risk Management, Integrated Teaming, Integrated Supplier Management, Quantitative Project Management)
3. **Engineering** (Requirements Development, Requirements Management, Technical Solution, Product Integration, Verification, Validation)
4. **Support** (Configuration Management, Process and Product Quality Assurance, Measurement and Analysis, Organizational Environment for Integration, Decision Analysis and Resolution, Casual Analysis and Resolution)

Process Area Capability vs Maturity

- Process area capability deals with a set of practices relating to a single process area.
- Process area maturity deals with a pre-defined set of process areas.



Continuous



Staged

Advantages - Staged

- Provides a proven sequence of improvements, each serving as a foundation for the next level
- Permits comparisons across and among organizations by the use of maturity levels
- Provides an easy migration from the SW-CMM to CMMI
- Provides a single rating

Disadvantages - Staged

- Skipping maturity levels is usually counterproductive

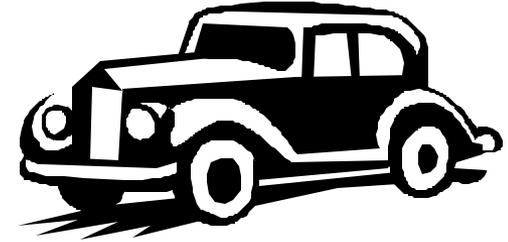
Advantages - Continuous

- Allows selection of the order of improvement that best meets the organization's objectives
- Enables comparisons across and among organizations on a process area by process area basis
- Affords an easy comparison of process improvement to the Software Process Assessment (ISO/IEC 15504)

Disadvantages - Continuous

- An overall rating for a set of processes cannot be established

Business Perspective Example



- Joe's Car Garage vs Jane's Car Garage Advertisement

**Joe's Car Garage – A CAPABILITY
LEVEL 3 Garage *****

**We are a Capability Level 3
garage!!!**

**We take great pride in specializing
in performing and managing our
defined car tune up process by
using the standard car tune up
process from our parent company
located in San Diego. We
customized this process just for the
Hampton Roads area. This gives us a
3 star capability rating!**

**This guarantees our customers a
consistently efficient car tune up.**

**Our car tune up process is so
efficient that we open our customer
feedback surveys to any customer
who may want to check our service
stats.**

**Jane's Car Garage – A MATURITY
LEVEL 3 Garage *****

We are a Maturity Level 3 Garage!!!

**We take great pride in specializing
in performing and managing not
only our tune up process, but we
do all of the other required checks
and fixes to be a 3 star mature
place of business. We perform
brake diagnostic, tire pressure
checks, emission system
diagnostics, exhaust system level
checks. Our defined 3 star car
maintenance processes comes
from our parent company located in
San Diego. We customized San
Diego's standard processes just
for the Hampton Roads area.**

**This guarantees our customers a
consistently efficient overall car
care.**

**Our car maintenance process is so
efficient that we open our customer
feedback surveys to any customer
who may want to check our service
stats.**

Local Maturity Level 3 Organizations

- SAIC Atlantic Programs Division (APD)
- Assessed at Maturity Level 3
- Three software development teams supporting LAFB were appraised
- 4500 document record examined
- 17 interviews conducted
- 18 processes used by the 3 teams were scrutinized

CMMI Model Description

CMMI Model

- Options
- Structure of Process Area
 - Process Areas
 - Generic or Common Features
 - Specific Features
 - Other components

CMMI Model Options

- Software Engineering (SW)
 - Original CMM Basis
 - Minimum area covered, i.e. CERES software
- System Engineering (SE)
 - Mating of hardware to software, i.e. ATM machine
 - Inclusion of production system
 - Data archive, disks, CPUs, etc.

CMMI Model Options

- Integrated Product and Process Development (IPPD)
 - More than one organization working on software, i.e. NASA, AS&M, and SAIC
 - Software and production system developed together, i.e. ASDC and SAIC
 - Agree on standard processes or accept each group's process
 - Software Engineering Committee is a start, but lacks empowered representatives

CMMI Model Options

- Supplier Sourcing (SS)
 - Obtaining services from someone else
 - Determining how to choose vendors
 - Acceptance of product
 - Example: IDL, CODINE, etc
 - Control process outside organization

CMMI Model

- Guides software engineering principles without dictating implementation
- Identifies relevant actions that are needed to successfully implement the principles
- Requires defined process
- Requires proof that the process is followed
- At higher levels, qualitative improvements

Definitions used in Model

- Practice – activity that is important to meet a goal
- Process – activities that implement practices in CMMI
- Process Area – related practices that satisfies a set of goals
- Goals – required model components used in appraisals

Definitions used in Model

- Generic – applies across process areas
- Specific – applies to a single process areas
- Common Features – organizes generic practices
- Work Products – results of a process

Definitions used in Model

- Purpose – brief statement on what is being accomplished
- Related Process Areas – areas that link to the particular area being described
- Notes – provides detail to any item
- Discipline Amplification – information specific to one of the 4 options
- Elaborations – explain how to apply a practice

Compliance Requirements

- Required – Specific and Generic Goals
 - Essential in achieving process improvement
 - Used in appraisals to determine maturity
- Expected – Specific and Generic Practices
 - Explain what will typically be done
 - Guide model users
 - Allow acceptable alternatives
- Informative – Everything else just provides details

Process Area Example

- Each Process Area is organized the same
- **Configuration Management** is used as an example
- Highlights of the model will be covered.

Purpose – Configuration Management

- The purpose of **Configuration Management** is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status account, and configuration audits.

Related Process Areas

Configuration Management

- Project Planning – develop plans and work breakdown structures
- Causal Analysis and Resolution – methods for analysis and evaluation
- Project Monitoring and Control – performance analyses and corrective action

Specific Goals (SG)

Configuration Management

- SG 1 - Establish Baselines
- SG 2 - Track and Control Changes
- SG 3 - Establish Integrity

Practices (SP)

SG 1 Establish Baselines

- SP 1.1 - Identify Configuration Items
 - List of Items under CM (Work Product)
 - Example Code, Test Plans, Operators Manual
- SP 1 .2 - Establish a Configuration Management System
 - System with controlled work products
 - Access control procedures
 - Change request database
- SP 1.3 - Create or Release Baselines
 - Baselines
 - Description of baselines

Practices

SG 2 Track and Control Changes

- SP 2.1 - Track Change Requests
 - Change Requests
- SP 2.2 - Control Configuration Items
 - Revision history
 - Archive of baselines
 - Check-in and Check-out procedures

Practices

SG 3 Establish Integrity

- SP 3.1 - Establish Configuration Management Records
 - Change Logs
 - Change Requests
 - Status of Items
- SP 3.2 – Perform Configuration Audits
 - Configuration Audit Results
 - Action Items

Subpractices

SP 2.2 Control Configuration Items

- 1. Control changes to configuration items throughout the life of product.
- 2. Obtain appropriate authorization before changed configuration item are entered into configuration management system.
- 3. Check in and check out configuration items from the configuration management system for incorporation of changes in a manner that maintains the correctness and integrity of configuration items.

Subpractices

SP 2.2 Control Configuration Items

- 4. Perform reviews to ensure that changes have not caused unintended effects on the baselines (e.g. ensure that the changes have not compromised the safety or security of the system).
- 5. Record changes to configuration items and the reason for the changes as appropriate.

Generic Goals (GG)

- GG 2 - Institutionalize a Managed Process (Maturity Level 2)
 - Planned and Executed According to Policy
 - Employed Skilled People with Resources
 - Produced Controlled Outputs
 - Monitored and Reviewed
 - Evaluated on Following Description
- GG 3 - Institutionalize a Defined Process (Maturity Level 3)
 - Tailored from Organizations Process
 - Maintained Process Description
 - Collected Metrics and Other Process Improvement Information

Common Features

- Commitment to Perform (CO)
 - Polices and sponsorship
- Ability to Perform (AB)
 - Establishing and maintaining plans, resources, assigned responsibility and authority, and training
- Directing Implementation (DI)
 - Managing the performance and integrity of process
- Verifying Implementation (VE)
 - Ensuring implementation and compliance

Generic Practices

- GP 2.1 - Establish an Organizational Policy
- GP 2.2 - Plan the Process
- GP 2.3 - Provide Resources
- GP 2.4 - Assign Responsibility
- GP 2.5 - Train People
- GP 2.6 - Manage Configuration
- GP 2.7 - Identify and Involve Relevant Stakeholders
- GP 2.8 - Monitor and Control the Process
- GP 2.9 - Objectively Evaluate Adherence
- GP 2.10 - Review Status with Higher Level Management
- GP 3.1 - Establish a Defined Process
- GP 3.2 - Collect Improvement Information

Managed Process Areas (Staged Level 2)

- Requirement Management
- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- Measurement and Analysis
- Process and Product Quality Assurance
- Configuration Management

Defined Process Areas (Staged Level 3)

- Requirement Development
- Technical Solution
- Product Integration
- Verification
- Validation
- Organizational Process Focus
- Organizational Process Definition
- Organizational Training
- Integrated Project Management
- Risk Management
- Integrated Teaming (IPPD)
- Integrated Supplier Management (SS)
- Decision Analysis and Resolution
- Organizational Environment for Integration (IPPD)

Quantitatively Managed (Staged Level 4)
Optimizing (Staged Level 5)
Process Areas

- Organizational Process Performance (4)
- Quantitative Project Management (4)
- Organizational Innovation and Deployment (5)
- Causal Analysis and Resolution (5)

CMMI Debrief

Application of CMMI to CERES DM

- What's the next (initial) step?
- Effects on personnel working on CERES DM
 - Formation of Software Improvement Processing Group?
 - Procedures will be defined
 - Procedures will be audited
 - Documentation, Code Reviews